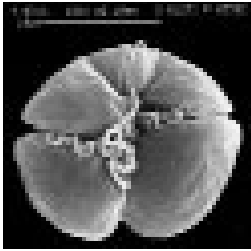


Scientists Discover Red Tide Toxin Caused Deaths in Dolphins and Manatees

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During a red tide bloom, millions of *Karenia brevis* organisms, shown magnified in the photograph, may be found in a single liter of seawater. (Photo: FWC)

New research findings have revealed that the toxins produced during Florida red tides do pose a threat to marine mammals, even after the blooms have disappeared. As reported in the June 9 issue of *Nature*, scientists from the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWC/FWRI) and the University of North Carolina Wilmington Center for Marine Science (UNCW/CMS), together with collaborators from Mote Marine Laboratory, Harbor Branch Oceanographic Institution and the National Oceanographic and Atmospheric Administration (NOAA), have discovered how red tide toxin accumulation and transfer in the food web, a series of interconnected food chains, resulted in mass fatalities of endangered manatees in 2002 and bottlenose dolphins in 2004.

In Florida, red tides cause massive fish kills and contaminate shellfish, making them unsafe for human consumption. They can cause respiratory problems in humans. Brevetoxins, the dangerous neurotoxins produced during Florida red tides (blooms of the toxic microalga *Karenia brevis*) also have been implicated in numerous mass marine mammal deaths in Florida. However, the mechanisms of intoxication leading to their deaths have remained uncertain.

"We knew that brevetoxins were involved in manatee mortalities, but we did not understand how these herbivorous mammals could be exposed to lethal amounts of toxins after the red tide had dissipated," said Leanne Flewelling of FWRI's Harmful Algal Blooms group and principal author of the publication. The authors reveal that brevetoxins can accumulate in high concentration on seagrass, the principal food source for manatees, and can remain there after the bloom is gone. This can be especially dangerous when the red tides form in early spring and the migrating manatees move to coastal waters, eating seagrass that has been exposed to the red tide toxins.

The involvement of brevetoxins in dolphin mortalities has been much debated, primarily because toxins were not always found in dead animals and because the source of the poisoning was not understood. "Because red tides typically result in massive fish kills, people believed that brevetoxins could not accumulate to concentrations dangerous for marine mammals that feed on whole live fish prey," said Jerome Naar, research assistant professor at UNCW/CMS and corresponding author in the publication.

Research Scientists Leanne Flewelling (FWC/FWRI), Jan Landsberg (FWC/FWRI), Karen Steidinger (FWC/FWRI), and Daniel Baden (UNCW/CMS) are co-authors in the *Nature* article with Naar. Funding for their studies on the potential for fish to accumulate brevetoxins by food-web transfer was provided by the Centers for Disease Control and Prevention, the Florida Department of Health and FWC.

The scientists reported that planktivorous (plankton-eating) fish can, in fact, feed on the red tide cells, but brevetoxin seems to be fatal to them only if the toxin passes through their gills. When there is only a low level of toxin dissolved in the seawater, these fish can become contaminated, particularly in the internal organs, and can cause fatalities in other species, such as dolphin or seabirds which rely on whole fish as a food source.

The 2004 spring mortality of 107 dolphins in the Florida Panhandle was the first evidence that brevetoxin-contaminated fish are a threat to dolphins. "Discovering exactly the same toxin composition in the dolphin stomachs as in the planktivorous fish gave us quite a good indication of what was responsible," Naar said. "The finding that red tide is this toxic to manatees and dolphins highlights the need for more research on the health effects of red tide toxin exposure in human populations," said David Schwartz, M.D., director of the National Institute of Environmental Health Sciences.

Despite documented annual red tides in the Gulf of Mexico since the late 1800s, there are no reports of human poisonings from fish consumption in red-tide impacted areas. The investigation of the dolphin mortality led by NOAA included multiple scientists from state and federal agencies, as well as other non-profit organizations and universities. Additional funding support for the study was obtained from the Center for Sponsored Coastal Ocean Research Harmful Algal Bloom Event Response Fund, the National Institute of Environmental Health Sciences, NOAA's Monitoring and Event Response for Harmful Algal Blooms program, and the NOAA Marine Biotoxins Program. For more information, contact Scott Willis, FWRI at: (727) 896-8696 or Scott_Willis@fwc.state.fl.

Note: This article appeared in the Summer 2005 issue of the newsletter of the Florida Keys National Marine Sanctuary, Sounding Line. For more information, visit: <http://floridakeys.noaa.gov>.